CLAIMS

What is claimed is:

1. A transducer comprising:

a fixed plate;

a first capacitive sensor array on the surface of said fixed plate, said first capacitive sensor array having a periodic pattern of conductive elements;

a suspension plate with a proof mass supported by a plurality of flexural elements engaging a frame, said plurality of flexural elements capable of constraining said proof mass to motion in a single axis;

a second capacitive sensor array on a surface of said proof mass, said second capacitive sensor array comprising a periodic pattern of equal periodicity to said first capacitive sensor array on said fixed plate, with the direction of the periodicity parallel to said constrained motion of said proof mass;

said fixed plate mounted to said frame of said suspension plate to allow said first capacitive sensor array and said second capacitive sensor array to be aligned in a common direction of periodicity in separated opposition;

an electrical connection to said first capacitive sensor array on said fixed plate allowing a coupling of cyclic excitations from external electronics through said periodic pattern of said first capacitive sensor array to said periodic pattern of said second capacitive sensor array, said coupling ranging between zero and one hundred percent and being a cycling positional measure of said proof mass with respect to said fixed

plate in said constrained planar direction;

an electrical connection to said proof mass sensor array transmitting a signal resulting from said coupling of said fixed plate sensor array to said proof mass sensor array to external electronics for determination of percentage of said coupling and transduce the position of said proof mass.

2. An accelerometer comprising:

said transducer of claim 1 having an electrostatic actuator emitting an actuation signal to move said proof mass in said constrained direction;

feedback electronics using said proof mass position determined from said transducer to produce a signal to drive said actuator to maintain said proof mass in approximately a null position;

limit control electronics in a path of said actuation signal for temporarily zeroing said actuation signal when said actuation signal exceeds preset limits;

a means to measure the resulting actuation feedback signal.

3. An accelerometer comprising:

said transducer of claim 1 having an electromagnetic actuator actuating said proof mass to move in said constrained direction;

feedback electronics using said proof mass position determined from said transducer to produce a signal to drive said actuator in a transconductance configuration to maintain said proof mass in approximately a null position within one cycle of the said position transducer;

limit control electronics in a path of said actuation signal for temporarily zeroing said actuation signal when said actuation signal exceeds preset limits;

a means to measure the resulting actuation signal.

4. A velocity sensor comprising:

said transducer of claim 1 having two electromagnetic actuators, a main feedback coil and an integrator feedback coil on said proof mass actuating said proof mass to move in said constrained direction;

feedback electronics using said proof mass position determined from said position transducer, said feedback electronics providing separate feedback currents to said main feedback coil and said integrator feedback coil, said main feedback coil and said integrator feedback coil nulling velocity input signals and position input signals to said transducer;

limit control electronics temporarily zeroing said signal to said integrator feedback coil when said signal exceeds preset limits;

a means to measure velocity output voltage within said feedback circuit.

5. The accelerometer of Claim 3 wherein said proof mass is comprised of two wafers bonded together and said electromagnetic actuator is located centrally between said two wafers to provide symmetric actuation.

6. The velocity sensor of Claim 4 wherein said proof mass is comprised of two wafers bonded together and said integrator

feedback coil is located centrally between said two wafers to provide symmetric actuation.

7. The accelerometer of Claim 2 having an additional electrostatic actuator to provide a calibration input.

8. The accelerometer of Claim 3 having an additional electromagnetic actuator to provide a calibration input.

9. The velocity sensor of Claim 4, having an additional electromagnetic actuator to provide a calibration input.

10. The accelerometer of Claim 2 having a fixed plate conducting element and a proof mass conducting element, each of said fixed plate conducting element and said proof mass conducting element patterned so that motion of said proof mass over its full range causing a monotonic increase in said coupling between said fixed plate and said proof mass; and

a connection of said fixed plate conducting element to electronics means, and a connection of said proof mass conducting element to said electronics means for determination of coupling capacitance indicating displacement of said proof mass.

11. The accelerometer of Claim 3 having a fixed plate conducting element and a proof mass conducting element, each of said fixed plate conducting element and said proof mass conducting element patterned so that motion of said proof mass over its full range causing a monotonic increase in said coupling between said fixed plate and said proof mass; and

a connection of said fixed plate conducting element to electronics means, and a connection of said proof mass conducting element to said electronics means for determination of coupling capacitance indicating displacement of said proof mass.

12. The velocity sensor of Claim 4 in addition having a fixed plate conducting element and a proof mass conducting element, each of said fixed plate conducting element and said proof mass conducting element patterned so that motion of said proof mass over its full range causing a monotonic increase in said coupling between said fixed plate and said proof mass; and

a connection of said fixed plate conducting element to electronics means, and a connection of said proof mass conducting element to said electronics means for determination of coupling capacitance indicating displacement of said proof mass.

13. The accelerometer of Claim 2 wherein the feedback electronics are integrated on a silicon wafer of the accelerometer through integrated circuit fabrication techniques.

14. The accelerometer of Claim 3 wherein the feedback electronics are integrated on a silicon wafer of the accelerometer through integrated circuit fabrication techniques.

15. The velocity sensor of Claim 4 wherein said feedback electronics are integrated on a silicon wafer of said velocity sensor through integrated circuit fabrication techniques.

16. The accelerometer of Claim 2 wherein said flexures allow in plane movement in two directions, said in plane movement detected by separate sensor arrays aligned in periodicity to said two directions.

17. The accelerometer of Claim 3 wherein said flexures allow in plane movement in two directions, said in plane movement detected by separate sensor arrays aligned in periodicity to said two directions.

18. The velocity sensor of Claim 4 wherein said flexures allow in plane movement in two directions, said in plane movement detected by separate sensor arrays aligned in periodicity to said two directions.

19. The accelerometer of Claim 16 wherein said constrained motion includes movement in a third axis , said movement in the third axis being detected by a pair of capacitance plates sensitive to the spacing of said fixed plate and said proof mass.

20. The accelerometer of Claim 17 wherein said constrained motion includes movement in a third axis , said movement in the third axis being detected by a pair of capacitance plates sensitive to the spacing of said fixed plate and said proof mass.

21. The velocity sensor of Claim 18 wherein said constrained motion includes movement in a third axis, said movement in the third axis being detected by a pair of capacitance plates sensitive to the spacing of said fixed plate and said proof mass.

22. The velocity sensor of Claim 4 with said feedback electronics driving said main feedback coil and said integrator feedback coil in a transconductance configuration.